BLM LIBRARY
88047638

6500

PROPERTY OF
Bureau of Land Management
D S C LIBRARY

NEVADA COOPERATIVE WILDLIFE RESEARCH

WINTER DEER RANGE SURVEY
RUBY-BUTTE STUDY, NEVADA

RICHARD L. DEPAOLI
PAUL T. TUELLER

QL
737
.U55
D476
1970

BLM LIBRARY
RS 150A BLDG. 50
DENVER FEDERAL CENTER
P.O. BOX 25047
DENVER, CO 80225

LD 8847638

~~ZT~~
~~0175~~
QL
737
.U55
D476
1970

WINTER DEER RANGE SURVEY

RUBY-BUTTE STUDY, NEVADA

Prepared by: Richard L. Depaoli
Paul T. Tueller

A Cooperative Study By The

RENEWABLE RESOURCES CENTER
UNIVERSITY OF NEVADA RENO

for the

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

and

STATE OF NEVADA FISH AND GAME DEPARTMENT

December 1970

BLM LIBRARY
RS 150A BLDG. 50
DENVER FEDERAL CENTER
P.O. BOX 25047
DENVER, CO 80225

INTRODUCTION

This survey was proposed in the fall of 1968 and conducted during the summer of 1969. It was sponsored by the Bureau of Land Management, the Nevada Fish and Game Department, and the University of Nevada Agricultural Experiment Station.

The location of the study was the Ruby-Butte Winter Range in northeastern Nevada. This winter range includes five divisions (Figure 1): the south Ruby Mountains, Bald Mountain, Mooney Basin, Spruce Mountain, and the northern end of the Cherry Creek Mountains. Both Federal and private lands were included.

The intent of this survey was to gather data on: cover of shrubs, grasses, and forbs by species; density and cover of pinyon and junipers by age class; density of curl-leaf mountain mahogany by age class; apparent vegetation and soil trend; a deer activity index (by pellet group counts); degree of hedging and age classes of shrubs; and production by important shrubs. Production data was precluded because of time and financial limitations.

A corollary purpose of the survey was to provide data for comparing food habits information with forage species availability and to assess the health of the winter range used by mule deer that summer in the Ruby and East Humboldt ranges.

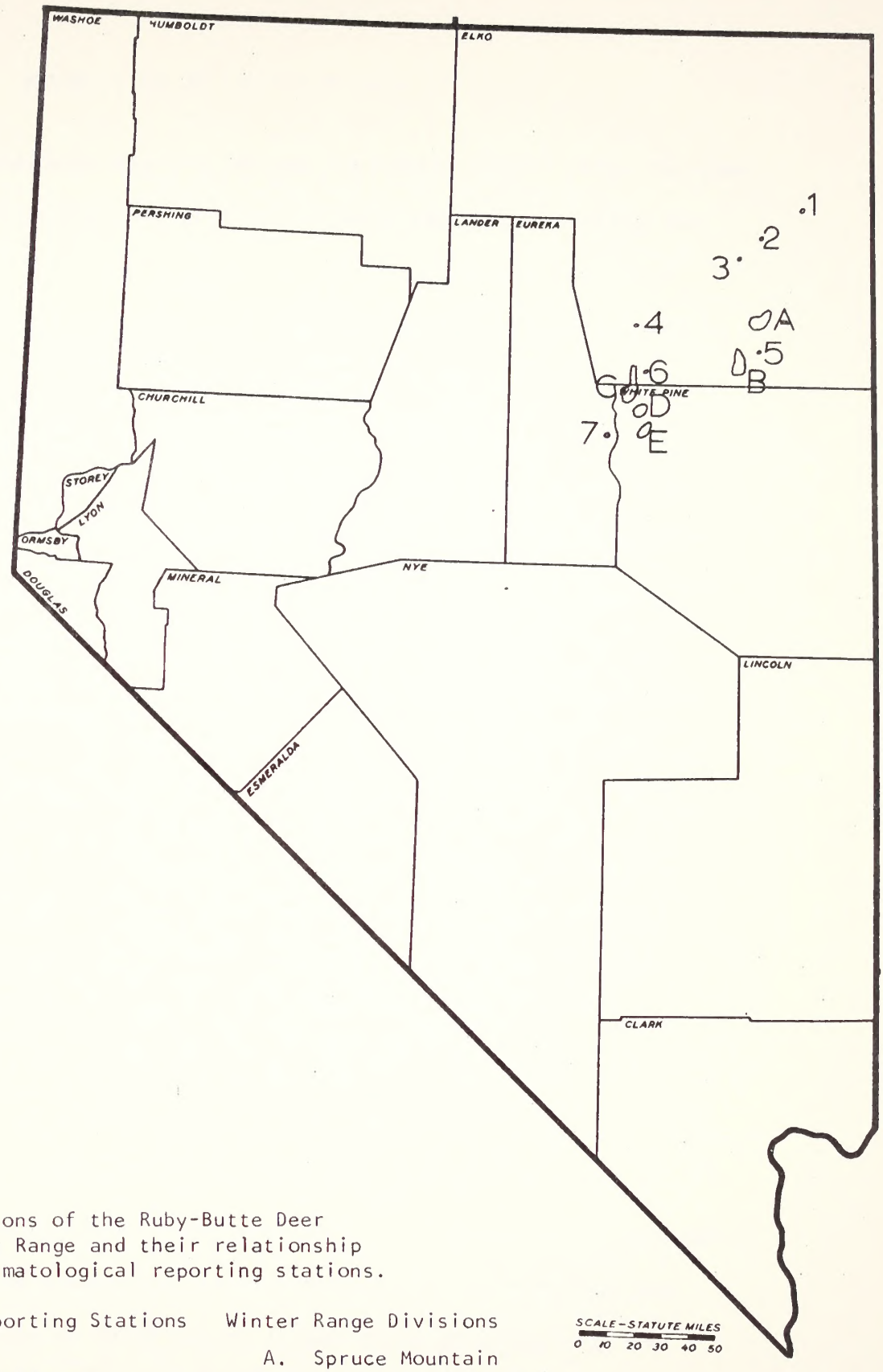


Figure 1. Locations of the Ruby-Butte Deer Winter Range and their relationship to climatological reporting stations.

Precipitation Reporting Stations

1. Pequops
2. Clover Valley
3. Arthur
4. Jiggs
5. Currie
6. Ruby Lake
7. Diamond Valley

Winter Range Divisions

A. Spruce Mountain
B. Cherry Creek Range
C. South Ruby Mountains
D. Bald Mountain
E. Mooney Basin

DESCRIPTION OF THE STUDY AREA

The south Ruby Mountains division of the Ruby-Butte winter range includes the strip of foothills on the east side of the Ruby Mountains starting just south of Harrison Pass and extending down to and including Overland Pass and vicinity. The vegetation consists of black sagebrush *(Artemisia nova)* and pinyon/juniper woodland *(Pinus monophylla)* and *(Juniperus osteosperma)* with some mixed bitterbrush *(Purshia tridentata)*, serviceberry *(Amelanchier pallida)*, and Big sagebrush *(Artemisia tridentata)*. The elevation of this area ranges from approximately 6000 feet to 7800 feet. The average precipitation for the area is 12.89 inches a year (taken at Ruby Lake; Table 1) falling mostly in the winter and spring.

Bald Mountain is located just south of Overland Pass. This division of the winter range is characterized by canyon bottoms and high basins, the lower areas are occupied mostly with pinyon/juniper woodland and the higher elevations with mountain brush *(Purshia tridentata, Artemisia tridentata, Symphoricarpos longiflorus)* and curl-leaf mountain mahogany *(Cercocarpus ledifolus)*. The approximate elevations are from 7000 feet to 8600 feet and precipitation is similar to that of the south Ruby Mountains.

The Mooney Basin division is located south of Bald Mountain. This area consists of a low basin with extensive bench land and a long, easy sloping canyon bottom. The basin and the benchland consists of pinyon/juniper woodland with mixed black sagebrush and the canyon bottom is covered with big sagebrush. The elevations range from 6600 feet to 7200 feet and the average precipitation is 10.78 inches a year (data obtained from the Diamond Valley Hall located just west of Mooney Basin at a lower elevation, Table 1).

TABLE 1. Climatological data from several reporting stations convenient to the survey area.

	Average Precipitation		Average Temperature	
	1967	1968	1967	1968
Cherry Creek	12.93	---	---	---
Clover Valley	11.93	13.90	---	---
Currie	6.36	---	44.6	---
Pequops	11.69	13.64	45.0	44.4
Jiggs	9.75	14.61	44.0	44.2
Ruby Lake	12.14	11.97	47.1	46.8
Arthur	16.28	15.91	44.3	44.6
Diamond Valley	10.30	11.26	43.7	42.7

Spruce Mountain just east of the Wells-Ely Highway is located approximately 22 miles northwest of Currie, Nevada. Canyon bottoms, adjacent steep ridges and benchland are found in this division of the winter range. The canyon bottoms are mostly big sagebrush, bitterbrush, snowberry *(Symphoricarpos longifolia)*, and rabbitbrush *(Chrysothamnus viscidiflorus* and *Chrysothamnus nauseosus)*. The higher ridges are mainly curl-leaf mountain mahogany with scattered pinyon and juniper. The benchland is made up of pinyon and juniper with mixed black sagebrush. The approximate elevations of this wintering area are from 6600 feet to 9000 feet. The average precipitation is slightly more than 12.91 inches a year (from the Clover Valley station, Figure 1). The Spruce Mountain winter deer ranges are higher in elevation than other sites and receive slightly more precipitation.

The north end of the Cherry Creek Range is located just west of Currie, Nevada and includes three major canyons and a lower foothills-benchland area. The canyons consist mostly of big sagebrush and rabbitbrush with some willow *(Salix* sp.*)* and Chokecherry *(Prunus virginiana)*. The adjacent ridges are pinyon and juniper with some mixed curl-leaf mountain mahogany and sporadic stands of quaking aspen *(Populus tremuloides)*. The snow pockets and wetter areas contain patches of mountain brush and the higher barren ridges are covered with low sagebrush *(Artemisia arbuscula)*. The lower foothills-benchland areas support pinyon/juniper with patches of curl-leaf mahogany and an understory of black sagebrush with scattered patches of big sagebrush, bitterbrush, and serviceberry. The foothills-benchland area is located on the west side of the range across from McDermitt Canyon. Approximate elevations vary from 6800 feet to 9000 feet. The average precipitation is similar to Spruce Mountain (12.91 inches).

METHODS

The study plots were selected for their relatively higher degree of vegetation homogeneity when compared with other stands of the same plant association found in the survey area. Interpretations were made according to the plant association and habitat type ecological concepts. A plant association is defined as a plant community characterized by a definite floristic composition, physiognomy, and structure and growing under similar habitat conditions (Hanson and Churchill, 1961). Associations are considered to be representative of potential natural vegetation. They may be near "climax" or seral depending upon the intensity of man-caused influences and the resultant degree of change.

A habitat type is defined as all the area (sum of descrete parts) that now supports, or within recent time has supported, and presumably is still capable of supporting one plant association (Daubenmire, 1952). Each habitat type is named by the "climax" association which characterizes it. When possible plant associations were interpreted as habitat types since data from other investigations may be available to enhance understanding of a particular site.

Every effort was made to choose macroplot sites that were representative for the entire winter range area. This was accomplished with the aid of aerial photographs and considerable field reconnaissance. As many different plant associations as possible were delineated whenever plant composition, physiognomy and habitat conditions were found to differ. The philosophy was adhered to that the data could be combined at a later date if found to be similar but that they could not be separated. In fact as the data were displayed on spread sheets for the development of association

tables several sites were judged to be examples of the same association.

Cover

Macroplots were established at each study site. They consisted of a 100-foot baseline (running up the slope) and four 50-foot transects placed perpendicular to the baseline. The four 50-foot transects were randomly located on the baseline. The direction from the baseline (left or right) was determined by the flip of a coin.

Each 50 foot tape was divided into ten 4' by 5' microplots, each with a 1' x 2' micro-plot situated in the lower left-hand corner. Shrub cover was estimated in the 4' x 5' micro- plots and grass and forb cover was determined in the 1' x 2' micro-plots.

Shrub cover was determined as canopy cover. A 1' x 1' square was used as an estimation guide and represented 5% of the total area in the 4' x 4' micro-plot. Grass and forb cover was measured as basal area with rings representing 2% and 5% of the plot used as estimation guides. Cover was determined by individual species. Percentages were totaled and a mean was found for each species, per plot. A mean percentage cover was also computed for the total of grasses, forbs, and shrubs for each plot.

Apparent Trend

Apparent trend of both the vegetation and soil was determined at each plot. A form procedure from the R-4 Range Analyses Handbook (Forest Service, 1964) was used to estimate trend. This form indicated vegetation and soil trend as up, stable, or down (Appendix A).

Density and Cover for *Juniperus osteosperma Pinus monophylla*

Juniper and pinyon cover was determined by age class per unit area. The plot size was 1 chain by 2 chains (66' x 132') with each plot extending

33 feet to each side of the 100-foot baseline. The plot then extended 132 feet up the slope, paralleling the 100-foot baseline 33 feet on each side. The total area represented by this 1 chain by 2 chain plot was 1/5 of an acre.

A count was taken of both pinyon and juniper in the plot by age class. The age classes used were those of Bradshaw and Reveal's (1943):

Single leaf pinyon

Class 1. Reproduction

From one-year seedlings, up to 4.5 feet in height or 0.5 d.b.h. Generally dense crown, straight vigorous stem. Crown rounded in shape due to wide-spreading branches. Bark smooth or flakey. Approximate age, 1 to 20 years.

Class 2. Immature

From 4.5 to 20 feet in height; 0.6 to 10 inches d.b.h. Crown dense, and low to ground practically concealing trunk and large branches; conical or rounded in shape. Bark fissures shallow. Approximate age, 20 to 100 years.

Class 3. Mature

From 10 to 30 feet in height; 6 to 16 inches d.b.h. Crown more sparse and open rounded in general outline, but becoming irregular. Trunk and large branches more exposed; lower branches tending to prune off. Terminal twigs relatively more compact. Bark fissures deep, more definite plate formation. Approximate age, 100 to 175 years.

Class 4. Overmature

Twelve feet or more in height; 10 inches or more d.b.h. Crown very sparse and open; rounded or flat-topped in general outline, but very irregular. Branches large and gnarled; little foliage near the ground or towards center of tree. Terminal twigs compact. Bark thick, corky, with more definite plates. Approximate age, 175 years or more.

Utah juniper

Class 1. Reproduction

From one year seedlings, up to 4.5 feet in height or 0.5 inch d.b.h. Generally not more than 4 inches in diameter at ground level. Crown typically slender and straggly, or conical, with prominent leader and main branch tips. Approximate age, 1 to 30 years.

Class 2. Immature

From 4.5 to 14 feet in height; 0.6 to 6 inches d.b.h.; 4 to 5 inches at stump height (one foot above ground). Crown pointed or rounded, symmetrical. Branches mostly slender erect or ascending at acute angles, terminating in vigorous tips which give a fringed appearance to profile view of tree. May or may not contain one or more stems suitable for smallest class of posts (6 inches in diameter at stump height, and 7 feet long to a 2-inch top). Approximate age, 30 to 125 years.

Class 3. Mature

From 14 to 20 feet in height; 3 to 12 inches d.b.h.; 8 to 11 inches at stump height. Crown ranging from obtusely pointed to rounded or flattened, becoming somewhat irregular in outline. Branches heavy, stouter, and somewhat gnarled, ascending at acute or obtuse angles in upper part of crown, the lower branches tending towards horizontal positions. Foliage on branches less dense toward center of tree, with dying out of smaller interior twigs, crown thus becoming more open then in the immature class. Tips of branches rounded and smooth to profile view. Generally contains one or more posts per tree. Approximate age, 125 to 200 years.

Class 4. Overmature

Fourteen feet or more in height; 6 inches or more d.b.h.; 12 inches or more at stump height. Crown rounded or flattened, always irregular in outline. Branches heavier often gnarled and twisted, and diverging from trunk or base at more horizontal or odd angles. Foliage sparse except at ends of branches, giving open crown. Tips of branches rounded and smooth in profile view. Many dead branches and twigs. Contains one or more posts. Approximate age, 200 years or older.

Mahogany Age Classes

Curl-leaf mahogany was grouped into four age classes. Factors for determining these age classes were as follows:

Class 1. Seedlings

Those plants which range from 1st year to one foot in height.

Class 2. Saplings

Those with a diameter generally less than 3 inches and having white smooth bark.

Class 3. Mature

Those with dark, rough bark with dense crown foliage and no dead branches.

Class 4. Decadent

Those having either open crowns or dead branches present, or both.

Utilization Index

Relative utilization by macroplot location and plant association was evaluated using a pellet group density index. Each macroplot was divided into 40 microplots, .0025 of an acre in size, with a radius of 5.89 feet. Five sets of four microplots each were counted 50 feet out in a perpendicular direction from the 100-foot macroplot baseline on each side, making a total of ten groups of 4 microplots each or 40 microplots. The ten groups were spaced 13 to 15 paces apart and the 4 microplots were spaced 4 paces apart in a square fashion (Figure 2).

An individual pellet group had to contain 5 or more pellets to be counted. All pellet groups were counted, both old and fresh groups. To get an estimated deer days use the total number of pellet groups was multiplied by 10. This total was then divided by 13 to get the total number of deer days use per acre.

Age Classes of Shrubs

Age classes of shrubs were determined as follows: (Forest Service Handbook R-4 Analysis Handbook, page 93.1).

Seedling - Very young plant, which has become firmly established and yet obviously a newcomer on the range. It is usually distinguished by its relative size, simple branching and succulent bark.

Young Plant - Larger than seedling with more complex branching and more fibrous bark, but does not show signs of maturity, such as rounding crowns.

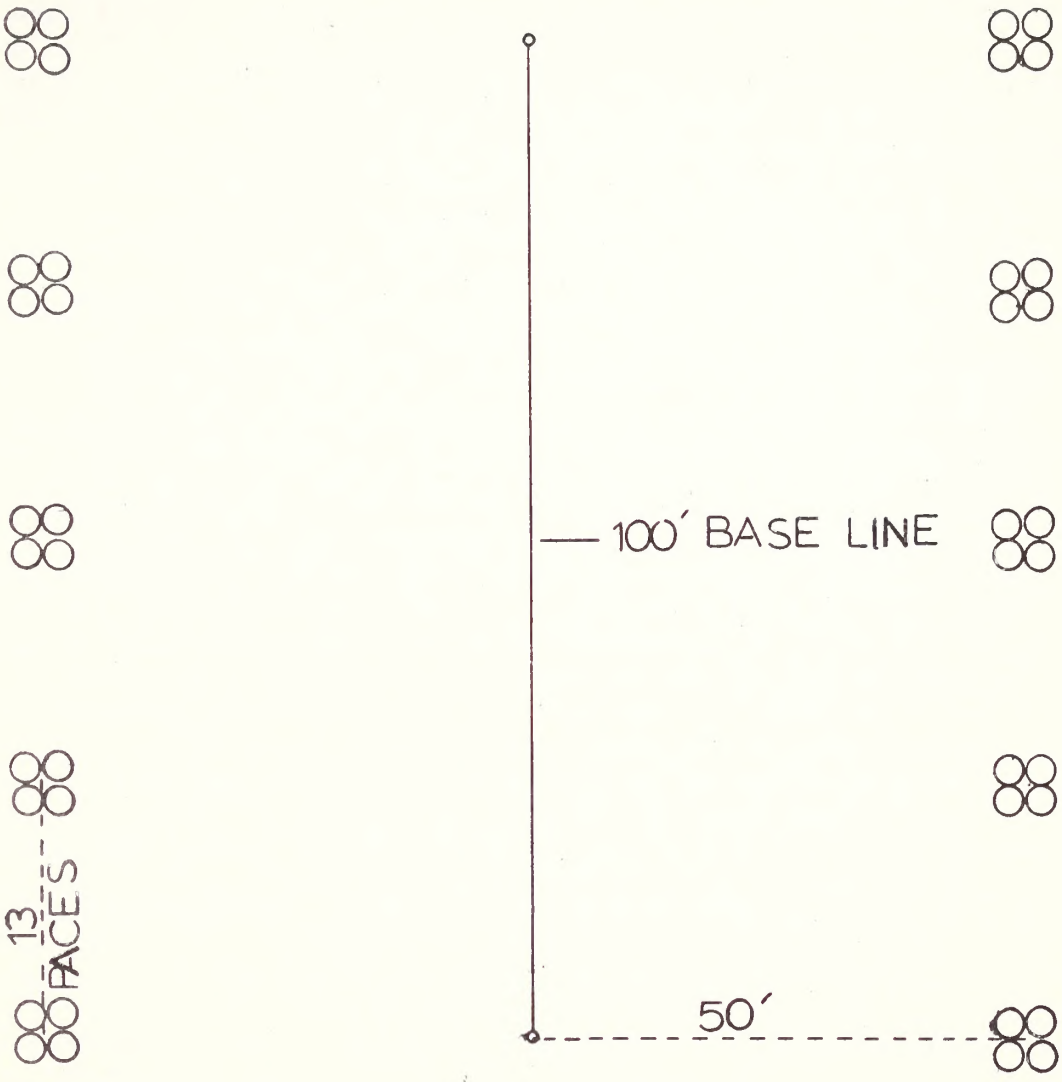


Figure 2. Plot locations in respect to the 100 foot base line for utilization counts (Deer pellets).

Mature Plant - Complex branching rounded growth form, larger size, heavier and often gnarled stems. Crown is made up of three-quarters or more of living wood.

Decadent Plant - Shrub or tree which is dying from age or other factors. Crown shows one-fourth or more dead wood.

Degree of Hedging

Degree of hedging was grouped into 8 categories. Shrubs were classified into these categories on an objective basis. (Forest Service Handbook, R-4 Range Analysis Handbook, page 93.1).

1. All available, little or no hedging
2. All available, moderately hedged
3. All available, closely hedged
4. Largely available, little or no hedging
5. Largely available, moderately hedged
6. Largely available, closely hedged
7. Mostly unavailable
8. Unavailable

DESCRIPTIONS OF THE PLANT ASSOCIATIONS

Purshia tridentata/Artemisia tridentata Association

This association usually occurs at elevations between 6400 and 7500 feet and may be found on any aspect of the lower ridges, sloping benchland or upper drainage bottoms. The northern slopes tend to have a more mesic vegetation with a greater number of species.

The association is characterized by the co-dominance of bitterbrush (5.90% cover) and big sagebrush (7.58% cover). The grass understory is dominated by cheatgrass *(Bromus tectorum)* with .44% cover. The forb layer is one of the most important of the survey area because of the great number of species. It is dominated by balsamroot *(Balsamorhiza sagittata)* with .08% cover (Table 2). The abundance of cheatgrass and balsamroot reflects the past heavy grazing on this association. As a result the understory has been opened to invasion by an increased abundance of less desirable species. Dead bitterbrush makes up approximately 20% of the total bitterbrush cover, showing signs of continuously heavy use.

This is the most important association on the deer winter range, it has an average deer days use per acre of 58.92 with a range of 39.24 to 79.23 (Table 3). The apparent reason for this variation is the locations of the macroplots, some are in less accessible spots (steep slopes) and some are in probable snow drift areas. There is a tendency towards heavier use in the more readily accessible areas (open wind-swept areas and canyon bottoms).

Both bitterbrush and big sagebrush are rated 3 as a degree of hedging, all available and closely hedged. Horse brush *(Tetradymia canescens)* and chokecherry *(Prunus virginiana)* were heavily used and rated 5 and 4, respectively (Table 4).

The apparent trend of the vegetation is stable and soil trend is up.

TABLE 2. Species Cover Percentages for the *Purshia Tridentata/ Artemisia tridentata* Association

	Average
Stipa comata	.23
Bromus tectorum	.44
Oryzopsis hymenoides	.15
Elymus cinereus	.01
Poa spp.	.17
Agropyron spicatum	.08
Agropyron smithii	.27
Festuca idahoensis	.31
Stipa lettermani	.01
Phlox spp.	.05
Amsinckia sp.	.01
Mustard sp.	.02
Penstemon sp.	t
Boraginaceae	.02
Hackelia floribunda	.04
Astragalus spp.	.01
Balsamorhiza sagittata	.08
Linum lewisii	t
Castilleja chromosa	.01
Cirsium sp.	t
Viola sp.	.09
Crepis acuminata	.02
Lupinus sp.	t
Lomatium sp.	t
Artemisia tridentata	7.58
Purshia tridentata	5.90
Chrysothamnus viscidiflorus	1.01
Tetradymia canescens	.36
Dead *Purshia tridentata*	1.54
Symphoricarpos longiflorus	1.87
Artemisia nova	.14
Juniperus osteosperma	.16

TABLE 3. Average Number of Deer Days Use by Plant Association - Ruby-Butte Deer Winter Range Survey Area

Association	Average	No. of Macroplots	Range	
*Putr/Artr**	58.92	4	39.24	79.23
Arno/Putr	47.69	1		
Chvi/Putr/Artr/Sylo	35.67	2	20.67	50.66
Chvi/Putr/Artr	49.62	1		
Artr/Arno/Putr	127.69	1		
Artr/Feid	37.23	1		
Arno/Artr	15.84	2	15.51	16.16
Artr/Grass	39.69	6	10.34	90.23
Artr/Sylo	30.49	7	7.69	65.12
Arno/Grass	16.88	4	9.23	26.15
Arno/Amal	28.46	1		
Amal/Chvi	9.12	1		
Arar/Grass	21.35	3	18.61	22.74
Pimo/Juos	10.15	4	5.17	20.67
Juos/Pimo/Putr/Artr	11.37	1		
Juos/Pimo/Putr	9.23	1		
Juos/Pimo/Artr	10.34	1		
Pimo/Juos/Arno	19.76	5	4.61	41.54
Juos/Arno	23.71	2	18.46	28.95
Pimo/Juos/Cele	15.38	1		
Cele/Grass	61.64	2	50.96	72.31
Cele/Artr	17.69	1		
Cele/Sylo/Chvi	185.38 (Sheep)	1		
Artr/Elci	102.27	1		
Artr/Brte	32.05			
Artr/Grsp	4.66	2	0.00	9.32
Artr/Chna	7.34	2	6.21	8.46

*Artr = *Artemisia tridentata*; Arno = *Artemisia nova*; Arar = *Artemisia arbuscula*; Amal = *Amelanchier alnifoliga*; Chna = *Chrysothamnus nauseosus*; Chvi = *Chrysothamnus viscidiflorus*; Grsp = *Grayia spinosa*; Putr = *Purshia tridentata*; Sylo = *Symphoricarpos longiflorus*; Juos = *Juniperus osteosperma*; Pimo = *Pinus monophylla*; Cele = *Cercocarpus ledifolius*; Brte - *Bromus tectorum*; Elci = *Elymus cinereus*; Feid - *Festuca idahoensis*.

TABLE 4. Degree of Hedging of Major Browse Species by Plant Community in Ruby-Butte Deer Winter Range Survey Area

Deer Winter Range Communities	Number of Macroplots	*Cele*		*Artr*		*Putr*		*Chvi*		*Teca*		*Sylo*		*Arno*		*Amal*		*Prvi*		*Eula*		*Sugl*		*Arar*		*Grsp*		*Juos*		*Pimo*	
		Aver	Range	Aver	Range	Aver	Range	Aver	Range	Aver	Range	Aver	Range	Aver	Range	Aver	Range	Aver	Range	Aver	Range	Aver	Range	Aver	Range	Aver	Range	Aver	Range	Aver	Range
Putr/Artr	4			3	1-7	3	1-6	2	1-2	5	2-7	2	1-2					4	2-6									1	1-1	1	---
Arno/Putr	1			1	---	2	---	1	---	1	---	1	---	1	---																
Chvi/Putr/Artr/Sylo	2			2	2-3	6	6-6	2	2-2	1	1-1	2	2-2			3	---											2	---	1	---
Chvi/Putr/Artr	1			2	---	7	---	3	---	1	---																				
Artr/Arno/Putr	1			3	---	7	---	6	---	2	---			3	---																
Artr/Feid	1			3	---			3	---			2	---					2	---												
Arno/Artr	2			1	1-2			2	2-2			1	---	2	2-2					1	---										
Artr/Grass	6			2	1-2	7	---	2	1-3	2	2-2	2	1-2			6	---											1	1-2		
Artr/Sylo	7			2	1-2	2	1-2	3	2-5	1	---					6	5-6	6	---			7	---								
Arno/Grass	4			2	1-2	2	1-3	3	2-7			2	---	3	2-3					2	---					3	---	1	1-1	1	1-1
Arno/Amal	1							2	---	1	---	2	---	2	---	6	---											1	---	1	---
Amal/Chvi	1			3	---	4	---	3	---	1	---					6	---														
Arar/Grass	3							2	1-3	1	1-2													3	1-6			1	---		
Pimo/Juos	4			2	2-3	4	2-6	2	2-3	1	---																	1	1-1	1	1-1
Juos/Pimo/Putr/Artr	1			3	---	7	---	2	---	1	---											6	---					1	---	1	---
Juos/Pimo/Putr	1					3	---																					1	---	1	---
Juos/Pimo/Artr	1			2	---			3	---	2	---	2	---	2	---	3	---											1	---	1	---
Pimo/Juos/Arno	5			2	---	5	5-6	6	---	2	---	3	---	3	2-6											2	---	1	1-1	1	1-1
Juos/Arno	2					5	4-6	2	2-2	1	---			2	2-2													3	1-6	1	1-1
Pimo/Juos/Cele	1	8	---									2	---	2	---	5	---											1	---	1	---
Cele/Grass	2	7	7-8	2	2-3	2	---	2	---			4	2-7															1	---	1	---
Cele/Artr	1	7	---	2	---			2	---	1	---	2	---			7	---														
Cele/Sylo/Chvi	1	7	---	2	---							5	---			5	---													1	---
Artr/Elci	1	8	---	1	---	4	---	2	---	1	---	2	---															1	---	1	---
Artr/Brte	1	8		3	---			3	---	2	---																				
Artr/Grsp	2			1	1-1			1	1-2											3	---					1	1-1				
Artr/Chna	2			1	1-1			2	2-2																						

Artemisia nova/Purshia tridentata Association

This association is found on the higher ridges and benchland of the winter range, at about 7400 feet elevation and can occur on any aspect. The shrub layer is co-dominated by black sagebrush (10.94% cover) and bitterbrush (6.20% cover). The grass forb understory is dominated by bluebunch wheatgrass and balsamroot with .48% cover and .02% cover, respectively (Table 5).

Deer days use per acre is 57.69 (Table 3). The degree of hedging suggests that browse use is evenly distributed throughout the association. Big sagebrush, little rabbitbrush *(Chrysothamnus viscidiflorus)*, horsebrush, snowberry, and black sagebrush are little or not hedged. Bitterbrush is all available and moderately hedged (Table 4). This low degree of hedging may account for the lack of dead bitterbrush in the association.

TABLE 5. Species Cover Percentages for the *Artemisia nova/Purshia tridentata* Association

	% Cover
Stipa comata	t
Bromus tectorum	.06
Oryzopsis hymenoides	.13
Poa sp.	.20
Agropyron spicatum	.48
Agropyron smithii	.05
Penstemon	.01
Balsamorhiza sagittata	.02
Crepis acuminata	.01
Delphinium sp.	.01
Purshia tridentata	6.20
Chrysothamnus viscidiflorus	.40
Tetradymia canescens	.29
Symphoricarpos longiflorus	.21
Artemisia tridentata	10.94

Chrysothamnus viscidiflorus/Purshia tridentata/ Artemisia tridentata/Symphoricarpos longiflorus Association

This association has developed at lower elevations in the winter range area, at elevations near 64000 feet. It is found on low, easy sloping ridges, in basins, and canyon bottoms.

Little rabbitbrush and bitterbrush are the co-dominant browse species with 7.41% cover and 7.01% cover, respectively. Sandberg bluegrass (.50% cover) and balsamroot (.15% cover) are dominant in the understory (Table 6). The amount of little rabbitbrush, Sandberg bluegrass and balsamroot suggests that the association has been heavily grazed in the past.

Bitterbrush is the most heavily used browse and is rated 6, largely available and closely hedged. Serviceberry is rated 3 and big sagebrush, little rabbitbrush, and snowberry are rated 2 (Table 4). Considerable dead bitterbrush reflects the heavy use of the browse species and makes up 25% of the total bitterbrush cover, also suggesting the past heavy use of the association. Deer days use per acre ranges from 20.67 to 50.66 with an average use of 35.67 (Table 3). The apparent trend of vegetation and soil is up.

TABLE 6. Species Cover Percentages for the *Chrysothamnus viscidiflorus /Purshia tridentata/Artemisia tridentata/Symphoricarpos longiflorus* Association

Species	% Cover
Stipa comata	.07
Bromus tectorum	.27
Oryzopsis hymenoides	.02
Elymus cinereus	.03
Poa secunda	.50
Agropyron spicatum	.07
Agropyron smithii	.06
Stipa ~~be~~ttermani	.22
Sitanion hystrix	.06
Phlox sp.	t
Penstemon sp.	.02
Hackelia floribunda	.03
Astragalus sp.	t
Balsamorhiza sagittata	.15
Crepis acuminata	.02
Lomatium sp.	t
Helianthus uniflora	.04
Lithospermum ruderale	.01
Eriogonum spp.	t
Aster sp.	t
Artemisia tridentata	3.62
Purshia tridentata	7.01
Chrysothamnus viscidiflorus	7.41
Tetradymia canescens	.13
Dead *Purshia tridentata*	2.19
Symporicarpos longiflorus	3.32
Pinus monophylla	.15

Chrysothamnus viscidiflorus/Purshia tridentata/ Artemisia tridentata Association

This association is found at the lower elevations of the winter range and in openings in the pinyon/juniper woodland.

Little rabbitbrush dominates the shrub layer with 10.02% cover. Subdominants are bitterbrush and big sagebrush with 5.02% cover and 2.08% cover, respectively. The forb and grass understory is dominated by phlox *(phlox* species) with .44% cover and Indian ricegrass *(Oryzopsis hymenoides)* with .73% cover. Pinyon *(Pinus monophylla)* and juniper *(Juniperus osteosperma)* make up 2.01% and 10.29% of the total cover, respectively.

The deer days use per acre is 49.62. The degree of hedging of browse ranges from 1 to 7 with different species. Bitterbrush was browsed the hardest and rated 7, mostly unavailable. Little rabbitbrush was rated 3, big sagebrush was rated 2, and horsebrush was rated 1 (Table 4). The cover of dead bitterbrush makes up almost 50% of the total bitterbrush cover, reflecting past heavy use of this species. The apparent trend of vegetation and soil is stable.

TABLE 7. Species Cover Percentages for the *Chrysothamnus viscidiflorus/Purshia tridentata/Artemisia tridentata* Association

Species	% Cover
Stipa comata	.07
Bromus tectorum	.23
Oryzopsis hymenoides	.73
Elymus cinereus	.03
Poa spp.	.14
Sitanion hystrix	.09
Phlox sp.	.44
Astragalus spp.	.05
Crepis acuminata	t
Leptodactylon pungens	.07
Cryptantha sp.	.07
Artemisia tridentata	2.08
Purshia tridentata	5.05
Chrysothamnus viscidiflorus	10.02
Tetradymia canescens	.04
Dead *Purshia tridentata*	4.87
Juniperus osteosperma	10.29
Pinus monophylla	2.01

Artemisia tridentata/Artemisia nova/ Purshia tridentata Association

This association occurs in canyon bottoms and extends up adjacent slopes. It may be found at elevations near 7000 feet and on any aspect.

Big sagebrush and black sagebrush are co-dominant with 1.40% cover and 5.37% cover, respectively. The grass and forb understory is dominated by bearded bluebunch wheatgrass *(Agropyron spicatum)* with 2.06% cover and balsamroot with .42% cover. Juniper makes up .30% of the cover and pinyon makes up .18% of the cover (Table 8).

This association is found in areas of little or no snow buildup and has received heavy use. The number of deer days use per acre was recorded as 127.69 (Table 3). Corresponding to the high deer days use, the degree of hedging is heavy for most browse species. Bitterbrush is mostly unavailable and rated 7. Little rabbitbrush is rated 6, and both big sagebrush and black sagebrush are rated 3 (Table 4). The apparent trend of the vegetation and soil is up.

TABLE 8. Species Cover Percentages for the *Artemisia tridentata/Artemisia nova/ Purshia tridentata* Association

Species	% Cover
Bromus tectorum	.07
Oryzopsis hymenoides	.08
Poa spp.	.14
Agropyron spicatum	2.06
Agropyron smithii	.03
Boraginaceae	.01
Astragalus spp.	.01
Balsamorhiza sagittata	.42
Castilleja chromosa	.01
Lomatium sp.	.01
Artemisia tridentata	1.40
Purshia tridentata	.63
Chrysothamnus viscidiflorus	1.40
Tetradymia canescens	.29
Symphoricarpos longiflorus	.05
Artemisia nova	5.37
Juniperus osteosperma	.30
Pinus monophylla	.18

Artemisia tridentata/Festuca idahoesis Association

This association is found on the west side of Spruce Mountain on north facing slopes. It has developed at elevations ranging from 7200 feet to 7800 feet and is encountered between the scattered stands of curl-leaf mountain mahogany *(Cercocarpus ledifolius)*.

This association contains extensive grass cover, both Idaho fescue *(Festuca idahoensis)* and Sandberg bluegrass with 6.08% cover and 1.55% cover, respectively. Balsamroot dominates the forb understory with .19% cover. The shrub layer is co-dominated by big sagebrush (2.70% cover) and snowberry (2.55% cover) (Table 9).

The deer days use per acre is 37.23 (Table 3). This relatively low use is not evident when looking at the degree of hedging of the few browse species present. Both big sagebrush and little rabbitbrush were rated as all available and closely hedged. Snowberry and chokecherry are rated 2 (Table 4). Even with this relatively heavy use of browse it is not an important deer winter range association because of its limited size and range. The apparent trend of vegetation and soil is stable.

TABLE 9. Species Cover Percentages for the *Artemisia tridentata/Festuca Idahoensis* Association

Species	% Cover
Poa sp.	1.55
Agropyron spicatum	.65
Festuca idahoensis	6.08
Penstemon sp.	.01
Hackelia floribunda	t
Astragalus spp.	.01
Balsamorhiza sagittata	.19
Linum lewisii	.01
Viola sp.	.14
Crepis acuminata	.06
Lupinus sp.	.01
Artemisia tridentata	2.70
Purshia tridentata	.03
Chrysothamnus viscidiflorus	2.19
Symphoricarpos longiflorus	2.55
Prums virginiana	.05
Rosa woodsii	.13

Artemisia nova/Artemisia tridentata Association

This association is probably a transition zone rather than a true association of the winter range. It has developed between the big sagebrush and black sagebrush associations at elevations ranging from 6600 feet to 7500 feet, depending upon rainfall.

It is co-dominated by big sagebrush and black sagebrush with 5.76% cover and 4.89% cover, respectively. The grass layer is dominated by Sandberg bluegrass with .66% cover. The forb understory is dominated by three species: phlox *(Phlox* species*)*, cryptantha *Cryptantha* species*)* and *Leptodactylon pungens* with .02% cover each (Table 10).

The deer days use per acre is 15.84 ranging from 15.51 to 16.16 (Table 3). Corresponding to the low deer use, the degree of hedging is low. Both black sagebrush and little rabbitbrush were the heaviest used browse and are rated 2, all available and moderately hedged (Table 4). The apparent trend of the vegetation is stable and soil trend is down.

TABLE 10. Species Cover Percentages for the *Artemisia nova/Artemisia tridentata* Association

Species	% Cover
Poa spp.	.66
Agropyron spicatum	.16
Sitanion hystrix	.03
Phlox sp.	.02
Mustard sp.	t
Crepis acuminata	t
Eriogonum spp.	t
Leptodactylon pungens	.02
Cryptantha sp.	.02
Cordylanthus ramosus	t
Senecio uintahensis	t
Artemisia tridentata	5.76
Chrysothamnus viscidiflorus	1.31
Symphoricarpos longiflorus	.04
Artemisia nova	4.89
Eurotia lanata	.26
Pinus monophylla	.47

Artemisia tridentata/Grass Association

This association can be encountered anywhere on the winter range from 6000 feet to 9000 feet. It ranges from open slopes to snow pockets and canyon bottoms.

This association is floristically the richest of any studied on the winter range. As many as 9 different grasses, 18 different forbs and 9 different shrubs may be found. It is dominated by big sagebrush with an average cover of 15.40%, lupine (*Lupinus* species) with a cover of .08%, and bearded bluebunch wheatgrass with a cover of .51% (Table 11). These sites probably represent an *Artemisia tridentata/Agropyron spicatum* habitat type.

Because of the range and extent of this association throughout the winter range it is one of the most important as a deer browse source. It has an average deer days use per acre of 39.69 and ranges from 10.34 to as much as 90.23 deer days use per acre. One reason for this variation of pellet counts is that low counts were taken at higher elevations in areas of heavy snow buildup and the higher counts were found in canyon bottoms and areas of little snow buildup.

There is little evidence of any continued heavy use of this association. Dead bitterbrush makes up 5% of the total bitterbrush cover. All other browse has received little or moderate hedging (Table 4). The apparent trend of the vegetation is up and the soil is stable.

TABLE 11. Species Cover Percentages for the *Artemisia tridentata*/Grass Association

Species	% Cover
Bromus tectorum	.10
Oryzopsis hymenoides	.04
Elymus cinereus	.04
Poa spp.	.45
Agropyron spicatum	.51
Agropyron smithii	.12
Stipa lettermani	.11
Sitanion hystrix	.05
Melica bulbosa	t
Phlox spp.	.04
Amsinckia sp.	t
Mustard sp.	t
Penstemon sp.	t
Hackelia floribunda	t
Astragalus spp.	.02
Balsamorhiza sagittata	.01
Linum lewisii	.02
Viola sp.	t
Crepis acuminata	.02
Lupinus sp.	.08
Helianthus uniflora	t
Eriogonum spp.	t
Comandra pallida	t
Cryptantha sp.	t
Aster sp.	t
Carex sp.	.01
Cordylanthus ramosus	t
Artemisia tridentata	15.40
Purshia tridentata	.19
Chrysothamnus viscidiflorus	6.02
Tetradymia canescens	.06
Dead *Purshia tridentata*	.01
Symphoricarpos longiflorus	.42
Ribes cerium	.02
Juniperus osteosperma	.06

Artemisia tridentata/Symphoricarpos longiflorus Association

This association has developed at the higher elevations of the winter range. It ranges from 7000 to about 8500 feet and is found for the most part on northern slopes where there is ample moisture.

It is one of the richest associations studied: nine grasses, 22 forbs, and 9 shrubs were encountered. The shrub layer is co-dominated by big sagebrush with 8.32% average cover and snowberry with 12.81% average cover. The understory is dominated by Idaho fescue with .71% average cover and Sandberg bluegrass with .46% average cover (Table 12). The forb layer is comprised mostly by penstemon *(Penstemon* spp.*)*, locoweed *(Astagalus* spp.*)*, lupine *(Lupinus* spp.*)*, and buckwheat *(Eriogonum* spp.*)*.

The average deer days use per acre is 30.49 with a range of 7.69 to 65.12 (Table 3). Variation in the range of deer days use may be a result of the distribution of the macroplots, some in more accessible spots such as on open slopes just above canyon bottoms. Another possible explanation is that there is greater use of this association by deer in the northern Cherry Creek Range than in any other area sampled.

Degree of hedging varies widely among the species. The most heavily hedged species are serviceberry with a rating average of 6, chokecherry with 6, and elderberry *(Sambucus glauca)* with 7 (Table 4). Other important browse species that were all available and moderately to heavily hedged were big sagebrush, bitterbrush and rabbitbrush. The apparent trend of vegetation was up and the soil trend was up or stable. The average cover of pinyon on these sites was only .09%.

TABLE 12. Species Cover Percentages for the *Artemisia tridentata/Symphoricarpos longiflorus* Association

Species	% Cover
Bromus tectorum	.03
Elymus cinereus	.27
Poa spp.	.46
Agropyron spicatum	.33
Agropyron smithii	.15
Stipa lettermani	.10
Bromus marginatus	.02
Melica bulbosa	.01
Festuca idahoensis	.71
Phlox sp.	t
Mustard sp.	t
Penstemon sp.	.07
Hackelia floribunda	t
Astragalus spp.	.01
Linum lewisii	.01
Castilleja chromosa	t
Viola sp.	.07
Crepis acuminata	.02
Lupinus sp.	.12
Lithospermum ruderale	t
Eriogonum spp.	.06
Cryptantha sp.	t
Cordylanthus ramosus	t
Senecio uintahensis	t
Comandra pallida	.03
Taraxacum officinale	.01
Allium sp.	t
Achillea lanulosa	t
Collinsia parviflora	t
Wyethia mollis	t
Geranium richardsonii	.02
Artemisia tridentata	8.32
Chrysothamnus viscidiflorus	4.23
Symphoricarpos longiflorus	12.81
Amelanchier alnifolia	.13
Prunus virginiana	.02
Rosa woodsii	t
Sambucus glauca	.10
Artemisia arbuscula	.03
Pinus monophylla	.09

Artemisia nova/Grass Association

This association occurs mostly on southeast and northwest slopes. Most examples of this vegetation are located on benches. They appear on an aerial photograph as fingers running through pinyon/juniper woodland, in lower basins, and on lower ridges. Elevations range from 6500 to 8200 feet.

It is dominated by black sagebrush with 12.36% cover. Sandberg bluegrass dominates the grass understory with .42% cover. The forb layer is co-dominated by *Phlox* sp. and *Eriogonum* sp. with .05% and .04% cover, respectively (Table 13).

This association is one of less importance as a source of deer browse on the winter range. It has an average deer days use of 16.88 and ranges from 9.23 to 26.15 (Table 2). These low counts were taken at lower elevations far from any permanent source of water and any protective cover for deer.

Degree of hedging is relatively low in this association corresponding to the low deer days use found here. The species heavily hedged but all available are black sagebrush and rabbitbrush (Table 3). Vegetation trend is stable and soil trend is down.

TABLE 13. Species Cover Percentages for the *Artemisia nova*/Grass Association

Species	% Cover
Oryzopsis hymenoides	.05
Poa spp.	.42
Agropyron spicatum	.31
Festuca idahoensis	.01
Sitanion hystrix	.03
Balsamorhiza hookeri	t
Phlox spp.	.05
Penstemon	t
Boraginaceae	t
Astragalus spp.	.01
Crepis acuminata	t
Lupinus spp.	t
Eriogonum sp.	.04
Cordylanthus ramosus	.02
Collinsia parviflora	t
Artemisia tridentata	.05
Purshia tridentata	t
Chrysothamnus viscidiflorus	1.71
Symphoricarpos longiflorus	.01
Artemisia nova	12.36
Juniperus osteosperma	.19
Pinus monophylla	.28

Artemisia nova/Amelanchier alnifolia Association

This association is encountered on adjacent slopes of small canyons at approximately 7400 feet elevation. Stands are usually found on a north, northwestern or northeastern slope, but may be found on other aspects.

The grass layer is dominated by bearded bluebunch wheatgrass (8.7% cover) and the forb layer by lupine (.15% cover). The shrub layer is dominated by black sagebrush (11.8% cover). The sub-dominates are snowberry and serviceberry with 1.83% and 1.08% cover, respectively (Table 14). Rabbitbrush makes up a considerable percentage of the total cover but is an increaser in this community.

The average number of deer days use per acre is 28.46 (Table 3). Serviceberry with a value of 6 for degree of hedging is the only browse to be heavily used (Table 4).

The amount of pinyon cover is .63% and juniper cover is 1.57%, showing signs of pinyon/juniper invasion (Blackburn and Tueller, 1970). The trend of the vegetation and soil is up.

TABLE 14. Species Cover Percentages for the *Artemisia nova/Amelanchier Alnifolia* Association

Species	% Cover
Elymus cinereus	t
Poa spp.	.06
Agropyron spicatum	.87
Penstemon sp.	t
Astragalus spp.	t
Crepis acuminata	t
Lupinus spp.	.15
Eriogonum sp.	t
Senecio uintahensis	.04
Collinsia parviflora	.01
Chrysothamnus viscidiflorus	4.31
Tetradymia canescens	.40
Symphoricarpos longiflorus	1.83
Artemisia tridentata	11.18
Amelanchier alnifolia	1.08
Juniperus osteosperma	1.57
Pinus monophylla	.63

Amelanchier alnifolia/Chrysothamnus viscidiflorus Association

This association is located on the east side of the Ruby Mountains at an elevation of 6400 feet. It is found on the east facing slope of a canyon drainage bottom just at the edge of an old, rather small, burn.

This burn has been seeded to grass *(Poa bulbosa)*. As a result, the community's understory is dominated by bluegrass *(Poa bulbosa)* (1.86% cover) with some crested wheatgrass (.21% cover). The forb layer is sparse, made up of few species. The dominant shrub is rabbitbrush with 9.38% cover. This species has obviously increased tremendously after the fire. Serviceberry is the sub-dominant shrub (2.36% cover)(Table 15).

This association is one of the more heavily hedged communities studied. Serviceberry was the hardest hit and had an average rating of 6. Bitterbrush had an average rating of 4 while big sagebrush and rabbitbrush were rated 3 (Table 4). The number of deer days use per acre is 9.12, suggesting that the greatest use of browse in this area may be by livestock (Table 3). The apparent trend of the vegetation and soil is up. The soil showed signs of past erosion but at the present time most soil movement has stopped.

TABLE 15. Species Cover Percentages for the *Amelanchier alnifolia/Chrysothamnus viscidiflorus* Association

Species	% Cover
Bromus tectorum	.35
Poa bulbosa	1.86
Agropyron cristatum	.21
Amsinckia sp.	t
Boraginaceae	.10
Crepis acuminata	.03
Collinsia parvifloria	.01
Lygodesmia spinosa	.01
Artemisia tridentata	.76
Purshia tridentata	.13
Chrysothamnus viscidiflorus	9.38
Tetradymia canescens	.23
Amelanchier alnifolia	2.36
Gutierrezia sarothrae	.48

Artemisia arbuscula/Grass Association

This association has developed in basins or small open flat areas, at elevations ranging from 7000 to 8000 feet. It is usually found on slopes of 2% to 10% and may occur on any aspect.

Low sagebrush *(Artemisia arbuscula)* dominates the shrub layer with 9.43% cover. There are only two other shrubs making up this layer, rabbitbrush with 2.10% cover and horsebrush *(Tetradymia canescens)* (.03% cover). Thirteen different species of forbs may be encountered with *Cryptantha* sp. dominating (.04% cover). Sandberg bluegrass dominates the grass layer with .33% cover (Table 16).

The deer days use per acre ranges from 18.61 to 22.74 with an average of 21.35 (Table 3). The three shrubs present are rated from 1 to 3 for degree of hedging. The horsebrush is rated 1, rabbitbrush is 2 and low sagebrush is rated 3. Hedging of low sagebrush ranged from 1 to 6, the most use being in the basin between Little Bald Mountain and High Bald Mountain and probably was due to livestock grazing (Table 4). The apparent trend of the vegetation was down and soil trend was up or stable.

TABLE 16. Species Cover Percentages for the *Artemisia arbuscula*/Grass Association

Species	% Cover
Poa spp.	.33
Agropyron spicatum	.11
Festuca idahoensis	.01
Sitanion hystrix	.08
Distichlis stricta	.26
Chaenactis douglasii	t
Agoseris glauca	t
Mertensia spp.	t
Phlox spp.	.02
Amsinckia sp.	t
Mustard sp.	t
Penstemon sp.	.01
Astragalus spp.	.01
Castilleja chromosa	.02
Crepis acuminata	t
Cryptantha sp.	.04
Aster sp.	.01
Comandra pallida	.03
Chrysothamnus viscidiflorus	2.10
Tetradymia canescens	.03
Artemisia arbuscula	4.43
Juniperus osteosperma	.14

Pinus monophylla/Juniperus osteosperma Association

Pinyon/juniper woodland is one of two wide-spread plant associations that constitute the largest part of the winter range. The association ranges from 6000 to 8000 feet. It occurs on benchland and ridges on every aspect.

It is co-dominated by pinyon with an average cover of 28.08% and juniper (23.26% cover). Shrub cover is absent in areas of climax or closed woodland. Scattered shrub cover is found in areas of pinyon/juniper invasion (Blackburn, 1967). Black sagebrush usually dominates the shrub cover (1.63%) with scattered big sagebrush, rabbitbrush, horsebrush, and bitterbrush also in the shrub layer. The grass layer is sparse with Sandberg bluegrass dominating with a cover of .10% . *Phlox* (.18% cover) dominates the forb layer (Table 17) and reflects heavy past use.

The average deer days use is 10.15 with a range of 5.17 to 20.67 (Table 3). The variation in pellet counts may be accounted for by the location of the macroplots. The lower counts were taken in closed communities of pinyon/juniper woodland (Blackburn and Tueller, 1970). The higher counts were taken where browse cover was more abundant with more forbs and grass in the understory. Degree of hedging of the browse species is low except for the occasional bitterbrush plants which had an average hedging rate of 4 ranging from 2 to 6 (Table 4). The apparent trend of vegetation is stable to down and soil trend is down.

TABLE 17. Species Cover Percentages for the *Pinus monophylla/Juniperus osteosperma* Association

Species	% Cover
Bromus tectorum	.01
Oryzopsis hymenoides	.04
Poa spp.	.10
Agropyron spicatum	.01
Agropyron smithii	.01
Sitanion hystrix	.04
Phlox spp.	.18
Mustard sp.	t
Astragalus spp.	.01
Balsamorhiza sagittata	.01
Viola sp.	t
Lupinus spp.	t
Eriogonum sp.	t
Cryptantha sp.	.01
Cordylanthus ramosus	t
Senecio uintahensus	t
Comandra pallida	t
Artemisia tridentata	.08
Purshia tridentata	t
Chrysothamnus viscidiflorus	.13
Tetradymia canescens	.02
Artemisia nova	1.63
Juniperus osteosperma	23.26
Pinus monophylla	28.08

Juniperus osteosperma/Pinus monophylla/ Purshia tridentata/Artemisia tridentata Association

This association is located sporadically throughout the pinyon/juniper woodland in open areas. Elevations of occurrence are similar to the elevations of the *Pinus monophylla/Juniperus osteosperma*, i. e., 6000 feet to 8000 feet. It is found for the most part on western slopes but may be found on any aspect.

The grass layer is co-dominated by Indian ricegrass *(Oryzopsis hymenoides)* and Sandberg bluegrass with an average cover of .06% for both. Bearded bluebunch wheatgrass has a cover of .04%. *Eriogonum* species dominates the forb layer (.09% cover). The shrub layer is dominated by bitterbrush (1.09% cover). Pinyon makes up 19.51% of the total cover and juniper makes up 14.93% (Table 18).

The number of deer days use per acre is 11.37 (Table 3). Hedging of browse species varies from 1 to 7, horsebrush being the least used and bitterbrush being heavily used and as a result is almost all unavailable (Table 4). Dead bitterbrush makes up 43% of the total bitterbrush cover showing the effect of continuous heavy use. The apparent trend of vegetation and soil is down.

TABLE 18. Species Cover Percentages for the *Juniperus osteosperma/Pinus monophylla/Purshia tridentata/Artemisia tridentata* Association

Species	% Cover
Bromus tectorum	.02
Oryzopsis hymenoides	.06
Poa spp.	.06
Agropyron spicatum	.04
Sitanion hystrix	.01
Phlox spp.	.02
Mustard sp.	.01
Penstemon sp.	.11
Eriogonum sp.	.09
Comandra pallida	.02
Artemisia tridentata	.13
Purshia tridentata	1.09
Chrysothamnus viscidiflorus	.21
Dead *Purshia tridentata*	.83
Juniperus osteosperma	14.93
Pinus monophylla	19.51

Juniperus osteosperma /Pinus monophylla/ Purshia tridentata Association

This association is encountered in the lower foothills of the northern part of the Cherry Creek Range at an elevation of near 6800 feet. Few species are present. It is dominated by juniper with 26.79% cover and pinyon with 7.21% cover. The shrub cover is made up of only one species, bitterbrush (1.95% cover). The forb layer consists of traces of mustard and the grass understory is co-dominated by Indian ricegrass and Sandberg bluegrass with .02% cover for both (Table 19).

The deer days use per acre is fairly low at 9.23 (Table 3). Live bitterbrush is heavily hedged but all available at a rate of 3 (Table 4). The amount of dead bitterbrush makes up approximately 34% of the total bitterbrush cover. The apparent trend of vegetation is stable and soil trend is down.

TABLE 19. Species Cover Percentages for the *Juniperus osteosperma/Pinus monophylla/Purshia tridentata* Association

Species	% Cover
Oryzopsis hymenoides	.02
Poa spp.	.02
Sitanion hystrix	.01
Mustard	t
Purshia tridentata	1.95
Dead *Purshia tridentata*	1.00
Juniperus osteosperma	26.79
Pinus monophylla	7.21

Juniperus osteosperma/Pinus monophylla/ Artemisia tridentata Association

This associaiton has developed at the upper reaches of the big sagebrush habitat where pinyon/juniper woodland has invaded on steep slopes adjacent to canyon bottoms. The elevations where this association is commonly found range from 6500 to 7000 feet.

Juniper makes up 14.47% of the total cover and pinyon makes up .48% of the cover. The shrub layer is dominated by big sagebrush (5.61% cover) and is sub-dominated by snowberry (1.18% cover). The grass and forb understory is dominated by bearded bluebunch wheatgrass with .55% cover and fireweed *(Amsinckia* sp.*)* with .06% cover (Table 20).

The deer days use per acre is low (10.34) (Table 3). The degree of hedging of the major browse species present is low. The two species heavily hedged are rabbitbrush and serviceberry at a rate of 3. Black sagebrush, snowberry, and big sagebrush all are rated 2 for degree of hedging (Table 4). The apparent trend of vegetation is up or stable and the soil trend is down.

TABLE 20. Species Cover Percentages for the *Juniperus osteosperma/Pinus monophylla/Artemisia tridentata* Association

Species	$ Cover
Bromus tectorum	.01
Poa spp.	.09
Agropyron spicatum	.55
Amsinkia sp.	.06
Boraginaceae	.03
Linum lewisii	t
Circium sp.	t
Crepis acuminata	t
Cryptantha sp.	t
Artemisia tridentata	5.61
Chrysothamnus viscidiflorus	.81
Tetradymia canescens	.52
Symphoricarpos longiflorus	1.18
Artemisia nova	.49
Amelanchier alnifolia	.30
Chrysothamnus nauseosus	.10
Juniperus osteosperma	14.47
Pinus monophylla	.48

Pinus monophylla/Juniperus osteosperma/ Artemisia nova Association

This association is the second of two communities which make up the biggest part of the winter range. It is found on the benchland and foothills of all portions of winter range areas. It ranges in elevation from 6400 feet to 7000 feet but is encountered for the most part at the highest elevations around 6800 feet. It may be found on any aspect but for the most part on east facing slopes.

Juniper cover is 31.57% and pinyon constitutes 28.69% of the total cover. Black sagebrush dominates the shrub layer with an average cover of 3.00%. The grass understory is co-dominated by Sandberg bluegrass and bearded bluebunch wheatgrass which cover .20% and .17% of the ground respectively. Phlox (.08% cover) dominates the forb layer (Table 21).

Deer days use per acre ranges from (Table 3) 4.61 to 41.54 with an average of 19.76. The two browse species used the hardest are bitterbrush with a rating of 5, ranging from 5-6, and rabbitbrush with a rating of 6. Hedging of the other species present were from 2 to 3 (Table 4). Dead bitterbrush cover was 3.6 times greater than live bitterbrush reflecting the past heavy use of this browse species. The apparent trend of the vegetation and soil is stable.

TABLE 21. Species Cover Percentages for the *Pinus monophylla/Juniperus osteosperma/Artemisia nova* Association

Species	% Cover
Stipa comata	t
Bromus tectorum	.01
Oryzopsis hymenoides	t
Poa spp.	.20
Agropyron spicatum	.17
Festuca idahoensis	.01
Sitanion hystrix	.01
Phlox spp.	.08
Mustard sp.	t
Boraginaceae	.01
Astragalus spp.	t
Eriogonum spp.	.01
Leptodactylon pungens	t
Cryptantha sp.	.01
Senecio uintahensis	t
Purshia tridentata	.15
Chrysothamnus viscidiflorus	.05
Tetradymia canescens	.03
Dead *Purshia tridentata*	.56
Artemisia nova	3.00
Grayia spinosa	.03
Juniperus osteosperma	31.57
Pinus monophylla	28.69

Juniperus osteosperma/Artemisia nova Association

This association covers the largest part of Mooney Basin. It is found on the benchland adjacent to the canyon bottom that runs through the basin. Stands range in elevation from about 6700 to 7200 feet and usually are located on east facing slopes.

Juniper makes up 28.34% of the total cover and pinyon makes up 5.95%. The shrub layer consists of black sagebrush (6.45% cover) and scattered amounts of bitterbrush, rabbitbrush, and horsebrush. The grass understory is dominated by bluegrass (.09% cover). Western wheatgrass *(Agropyron smithii)* and squirreltail *(Sitanion hystrix)* both have a cover percentage of .06. Phlox dominates the forb layer with .30% cover (Table 22).

The average deer days use per acre is 23.71 and ranges from 18.46 to 28.95 (Table 3). Bitterbrush was heavily used with a rating of 5, rabbitbrush and black sagebrush were moderately hedged and rated 2 (Table 4). Cover of dead bitterbrush made up 47% of the total bitterbrush cover showing past heavy use. Apparent trend of the vegetation is stable and soil trend is down.

TABLE 22. Species Cover Percentages for the *Juniperus osteosperma/Artemisia nova* Association

Species	% Cover
Oryzopsis hymenoides	.02
Elymus cinereus	t
Poa spp.	.09
Agropyron smithii	.06
Sitanion hystrix	.06
Phlox spp.	.30
Mustard sp.	t
Astragalus spp.	t
Crepis acuminata	t
Eriogonum sp.	.05
Leptodactylon pungens	t
Cryptantha sp.	.05
Cordylanthus ramosus	.01
Senecio uintahensis	.01
Comandra pallida	.01
Purshia tridentata	.97
Chrysothamnus viscidiflorus	.37
Tetradymia canescens	.17
Dead *Purshia tridentata*	.86
Artemisia nova	6.45
Juniperus osteosperma	28.34
Pinus monophylla	5.95

Pinus monophylla/Juniperus osteosperma/ Cercocarpus ledifolius Association

This association is encountered in every area of the winter range except Mooney Basin. It ranges in elevation from 6800 feet to 8000 feet and may occur on any aspect. The largest part of this association is found in north end of the Cherry Creek Range and on Spruce Mountain.

Pinyon with a cover of 74.69% dominates the association. Juniper makes up 10.49% of the total cover (Table 23). Curl-leaf mountain mahogany *(Cercocarpus ledifolius)* was counted by age class. There were 25 reproduction, 5 immature, and 30 overmature plants per acre (Table 24). The thick crown cover precludes a thick understory. Snowberry dominates the shrub layer with .30% cover. Prickly pear cactus *(Opuntia* sp.*)* and Sandberg bluegrass dominate the forb and grass understory with .04% and .02% cover, respectively (Table 23).

The average deer days use per acre is 15.38 (Table 4). Serviceberry is the hardest hit in this community with a hedging rate of 5. The curl-leaf mountain mahogany is almost all unavailable due to extreme highlining from past heavy browsing. Snowberry and black sagebrush are only moderately hedged (Table 3). The apparent trend of the vegetation and soil is down.

TABLE 23. Species Cover Percentages for the *Pinus monophylla/Juniperus osteosperma/Cercocarpus ledifolius* Association

Species	% Cover
Poa spp.	.02
Agropyron spicatum	.01
Opuntia sp.	.04
Phlox spp.	.01
Mustard sp.	.01
Chrysothamnus viscidiflorus	t
Symphoricarpos longiflorus	.30
Artemisia tridentata	t
Amelanchier alnifolia	.05
Juniperus osteosperma	10.49
Pinus monophylla	74.65
Cercocarpus ledifolius	See Table 24

TABLE 24. Density by Age Class/Acre for *Cercocarpus ledifolius* by Plant Association

	Pinus monophylla/ Juniperus osteosperma/ Cercocarpus ledifolius Association	*Cercocarpus ledifolius*/ Grass Association	*Cercocarpus ledifolius/ Artemisia tridentata* Association	*Cercocarpus ledifolius Symphoricarpos longiflorus/Chrysothamnus viscidiflorus* Association
Reproduction	25	0	20	0
Immature	5	0	10	0
Mature	20	55	45	10
Overmature	30	238	165	50

Cercocarpus ledifolius/Grass Association

This association occurs sporadically throughout the winter range at higher elevations from 7500 feet to 8500 feet and may be encountered on any aspect.

Curl-leaf mountain mahogany dominates the association with an average of 55 mature and 23.85 overmature individuals per acre. There are no plants in the reproduction or immature age classes present (Table 24). The shrub layer is dominated by snowberry with 3.55% cover. The forb understory is sparse but *Penstemon* sp. dominates with .05% cover. The grass layer is co-dominated by *Stipa lettermani* and bluebunch wheatgrass with .48% and .44% cover, respectively (Table 25).

The average deer days use per acre is 61.64 (Table 3). This relatively high use is reflected in the degree of hedging (highlining). Curl-leaf mountain mahogany, which is mostly unavailable, is rated 7. Snowberry is rated 4, and big sagebrush, bitterbrush and rabbitbrush are rated 2 (Table 4). The apparent trend of the vegetation and soil is stable.

TABLE 25. Species Cover Percentages for the *Cercocarpus ledifolius*/Grass Association

Species	% Cover
Bromus tectorum	t
Oryzopsis hymenoides	.01
Poa spp.	.18
Agropyron spicatum	.44
Festuca idahoensis	.01
Stipa lettermani	.48
Stitanion hystrix	t
Phlox sp.	t
Penstemon sp.	.05
Crepis acuminata	t
Eriogonum spp.	t
Aster sp.	t
Cordylanthus ramosus	t
Comandra pallida	t
Artemisia tridentata	.43
Purshia tridentata	.01
Chrysothamnus viscidiflorus	.65
Tetradymia canescens	.01
Symphoricarpos longiflorus	3.55
Amelanchier alnifolia	.03
Juniperus osteosperma	.08
Pinus monophylla	.31
Cercocarpus ledifolius	See Table 24

Cercocarpus ledifolius/Artemisia tridentata Association

This association has developed at the highest elevations near 8800 feet and may be found on any aspect.

It is dominated by curl-leaf mountain mahogany with 20 reproduction, 10 immature, 45 mature and 165 overmature individuals per acre (Table 24). The grass understory is dominated by cheatgrass with 22% cover. Forbs are sparse. Big sagebrush dominates the shrub layer with 6.12% cover (Table 26).

Deer days use per acre is 17.69 for this community (Table 3). Curl-leaf mahogany is mostly unavailable due to extreme highlining. Another important mostly unavailable browse is serviceberry with a degree of hedging of 7 (Table 4). The apparent trend of the vegetation is up and soil trend is stable.

TABLE 26. Species Cover Percentages for the *Cercocarpus ledifolius /Artemisia tridentata* Association

Species	% Cover
Bromus tectorum	.22
Poa spp.	.06
Agropyron spicatum	.12
Sitanion hystrix	.01
Mustard sp.	t
Artemisia tridentata	6.12
Tetradymia canescens	.07
Symphoricarpos longiflorus	3.90
Amelanchier alnifolia	t
Pinus monophylla	.51
Cercocarpus ledifolius	See Table 24

Cercocarpus ledifolius/Symphoricarpos longiflorus Chrysothamnus viscidiflorus Association

This association is found at higher elevations near 8000 feet. It occurs occasionally throughout the heavily used mahogany dominated associations. It may occur on any aspect but is usually found on west facing slopes.

It is dominated by curl-leaf mountain mahogany with 15 mature and 50 over-mature individuals per acre, no reproduction or immature age class individuals were present (Table 24). The grass and forb understory is dominated by cheat-grass with .30% cover. Snowberry and rabbitbrush co-dominate the shrub layer with 8.64% cover and 3.23% cover, respectively (Table 27).

Deer days use per acre was exceptionally high 185.38 (Table 3). This is accounted for by the very heavy use of this site by sheep. Again curl-leaf mountain mahogany is mostly unavailable due to highlining. Snowberry and serviceberry are largely available and moderately hedged with a rating of 5 (Table 4). The apparent trend of the vegetation is up and the soil trend is down.

TABLE 27. Species Cover Percentages for the *Cercocarpus ledifolius/Symphoricarpos longiflorus/Chrysothamnus viscidiflorus* Association

Species	% Cover
Bromus tectorum	.30
Oryzopsis hymenoides	.02
Poa spp.	.04
Agropyron spicatum	.05
Agropyron smithii	.03
Stipa lettermani	t
Sitanion hystrix	t
Phlox spp.	.02
Penstemon sp.	.01
Boraginaceae	.04
Balsamorhiza sagittata	.02
Crepis acuminata	.01
Aster sp.	.02
Artemisia tridentata	.25
Chrysothamnus viscidiflorus	3.23
Symphoricarpos longiflorus	8.64
Amelanchier alnifolia	.03
Pinus monophylla	.41
Cercocarpus ledifolius	See Table 24

Artemisia tridentata/Elymus cinereus Association

This plant association is usually found in or near canyon bottoms and ranges in elevations from 6000 feet to 6500 feet.

It is dominated by big sagebrush (14.10% cover). The forb layer is dominated by phlox with 4.40% cover. The grass understory is co-dominated by *Elymus cinereus* with 1.19% cover and bearded bluebunch wheatgrass with 2.73% cover (Table 28).

The deer days use per acre is 102.27 (Table 3). Bitterbrush and mountain mahogany were the heaviest used browse species. Bitterbrush is rated 4 and mountain mahogany is unavailable (Table 4). The apparent trend of the vegetation is stable and soil trend is up.

TABLE 28. Species Cover Percentages for the *Artemisia tridentata/Elymus cinereus* Association

Species	% Cover
Stipa comata	.01
Elymus cinereus	1.19
Poa sp.	.49
Agropyron spicatum	2.73
Stipa lettermani	.26
Phlox sp.	4.40
Balsamorhiza sagittata	.01
Crepis acuminata	.25
Lupinus sp.	.01
Helianthus uniflora	.14
Artemisia tridentata	14.10
Purshia tridentata	.06
Chrysothamnus viscidiflorus	1.46

Artemisia tridentata/Bromus tectorum Association

This association has developed on open south slopes at elevations ranging from 6000 feet to 7000 feet. It was probably a big sagebrush-bearded bluebunch wheatgrass habitat type before the invasion by cheatgrass. Big sagebrush dominates the shrub layer with 8.96% of the total cover. Rubber rabbitbrush *(Chrysothamnus nauseosus)* and horsebrush are sub-dominates with 2.47% and 1.48% cover, respectively. The grass understory is now dominated by cheatgrass (.43% cover). Bluebunch wheatgrass presently remains as a remnant on the site with only .03% cover. The forb layer is sparse with *Linum lewisii* dominating with .04% cover (Table 29).

Deer days use per acre is 32.05 (Table 3). The degree of hedging is moderate with big sagebrush and little rabbitbrush rated 3 and horsebrush 2 (Table 4). The apparent trend of the vegetation is stable and soil trend is down.

TABLE 29. Species Cover Percentages for the *Artemisia tridentata/Bromus tectorum* Association

Species	% Cover
Bromus tectorum	.43
Poa sp.	.01
Agropyron spicatum	.03
Festuca idahoensis	.06
Mustard sp.	t
Linum lewisii	.04
Lygodesmia spinosa	.06
Artemisia tridentata	8.96
Chrysothamnus viscidiflorus	.82
Tetradymia canescens	1.48
Chrysothamnus nauseosus	2.47

Artemisia tridentata/Grayia spinosa Association

These stands are located at low elevations around 6600 feet in canyon bottoms and low drainage areas and mostly on east facing slopes. The association is co-dominated by big sagebrush and spiny hopsage *(Grayia spinosa)* with 8.72% cover and 7.04% cover, respectively. The grass and forb understory is dominated by bluegrass with .25% cover and mustard with .01% cover (Table 30).

This association is relatively unimportant for deer browse. The deer days use per acre is 4.66 ranging from 0.00 to 9.32 (Table 3). Corresponding to this low deer days use is the light hedging of browse species. The only browse present that was closely hedged was winter fat *(Eurotia lanata)* rated as 3 (Table 4) and was probably grazed by cattle. The apparent trend of the vegetation and soil is stable.

TABLE 30. Species Cover Percentages for the *Artemisia tridentata/Grayia spinosa* Association

Species	% Cover
Bromus tectorum	t
Oryzopsis hymenoides	.02
Elymus cinereus	.01
Poa spp.	.25
Sitanion hystrix	.03
Distichlis stricta	t
Mustard sp.	.01
Astragalus spp.	t
Artemisia tridentata	8.72
Chrysothamnus viscidiflorus	5.12
Eurotia lanata	.07
Grayia spinosa	7.04
Juniperus osteosperma	.07

Artemisia tridentata/Chrysothamnus nauseosus Association

This association is encountered in canyon bottoms and found mostly at elevations from 6000 feet to 7000 feet, on any aspect. This seral association was most likely an *Artemisia tridentata*/Grass habitat type before rubber rabbitbrush increased. It is now dominated by big sagebrush (57.84% cover) and rubber rabbitbrush (8.44% cover). The grass understory is dominated by salt grass *(Distichlis stricta)* with .52% cover. The forb layer is co-dominated by bastard toad flax *(Comandra pallida)*, Aster *(Aster* sp.*)* and yarrow *(Achellea lanulosa)* with .07%, 106% and .05%, respectively (Table 31).

This association is relatively unimportant for deer use. The total deer days use per acre is 7.34 ranging from 6.21 to 8.46 (Table 3). The degree of hedging is low, only an occasional winter fat plant was closely hedged with a rating of 3 (Table 4). The apparent trend of the vegetation and soil was stable.

TABLE 31. Species Cover Percentages for the *Artemisia tridentata/Chrysothamnus nauseosus* Association

Species	% Cover
Bromus tectorum	.01
Poa spp.	.07
Agropyron smithii	.05
Sitanion hystrix	t
Distichlis stricta	.52
Juncus balticus	t
Mustard sp.	.02
Penstemon sp.	.02
Aster spp.	.04
Cordylanthus ramosus	t
Comandra pallida	.07
Taraxacum officinale	.06
Achillea lanulosa	.05
Lilium sp.	.01
Artemisia tridentata	57.84
Chrysothamnus viscidiflorus	2.14
Artemisia nova	1.32
Chrysothamnus nauseosus	8.44

SUMMARY AND CONCLUSIONS

These data suggest that the most important plant associations with regard to the extent of deer use were the *Artemisia tridentata/Artemisia nova/Purshia tridentata* and *Artemisia tridentata/Elymus cinereus* plant associations (Appendix C). These associations had 127.69 deer days use and 102.27 deer days use, respectively. The *Cercocarpus ledifolius/Symphoricarpos longiflorus / Chrysothamnus viscidiflorus* plant associations on Spruce Mountain had a use index of 185.38 deer days use per acre but was influenced by a high degree of sheep use in the area. These three associations were found to have high deer index values but are not considered to be the most important associations on the winter range. This is due to their limited distribution over the entire survey area.

With this in mind, the survey indicates that the most important plant associations, owing to their overall distribution and deer use per acre, are the *Cercocarpus ledifolius*/Grass associations and the *Purshia tridentata/Artemisia tridentata* associations (61.64 deer days use per acre and 58.92 deer days use per acre, respectively). The latter association has a lower deer utilization index but is thought to be more important since it is more commonly found throughout the winter range.

Two other plant associations with relatively high deer use that are also found throughout the survey area are the *Chrysothamnus viscidiflorus/Purshia tridentata/Artemisia tridentata* (49.62 deer days use) and *Artemisia nova/Purshia tridentata* (47.69 deer days use) associations.

Four associations that are sporadically found on the winter range that have similar deer days use are *Artemisia tridentata/Festuca idahoensis* associations (37.23 deer days use), *Chrysothamnus viscidiflorus/Purshia*

tridentata/Artemisia tridentata/Symphoricarpus longiflorus associations (35.67 deer days use), *Artemisia tridentata/Bromus tectorum* associations (32.05 deer days use), and the *Artemisia nova/Amelanchier alnifolia* associations (28.46 deer days use).

This survey also showed that the plant associations which make up the largest percentage of the winter range area generally have the lowest deer use. The *Juniperus osteosperma/Artemisia nova* associations (23.71 deer days use), *Pinus monophylla/Juniperus osteosperma/Artemisia nova* associations (19.76 deer days use), *Cercocarpus ledifolius/Artemisia tridentata* associations (17.69 deer days use), the *Pinus monophylla/Juniperus osteosperma/Cercocarpus ledifolius* associations (15.38 deer days use), the *Juniperus osteosperma/Pinus monophylla/Purshia tridentata/Artemisia tridentata* associations (11.37 deer days use), the *Juniperus osteosperma/Pinus monophylla/Artemisia tridentata* association (10.34 deer days use), the *Pinus monophylla/Juniperus osteosperma* associations (10.15 deer days use), and the *Juniperus osteosperma/Pinus monophylla/Purshia tridentata* associations (9.23 deer days use).

The lowest deer use was found in the *Artemisia tridentata/Chrysothamnus nauseosus* associations (7.34 deer days use) and in the *Artemisia tridentata/Grayia spinosa* associations (4.66 deer days use). These two associations are found only in the lower canyon bottoms in the winter range.

The two plant associations that had the highest degree of hedging on the major browse species are those with the highest deer utilization indices, the *Artemisia tridentata/Artemisia nova/Purshia tridentata* and *Chrysothamnus viscidiflorus/Purshia tridentata/Artemisia tridentata* associations. These two associations and the *Juniperus osteosperma/Pinus monophylla/Purshia tridentata/Artemisia tridentata* associations, and the *Artemisia tridentata/*

Grass associations had similar degrees of hedging on the major browse species. All of these had a rating of 7, mostly unavailable, for bitterbrush. The exceptionally heavy hedging may be accounted for by the low densities of major browse species present within these associations.

The next cluster of associations with similar browse use also have similar deer days use per acre. These associations in rank of browse use are *Chrysothamnus viscidiflorus/Purshia tridentata/Artemisia tridentata/Symphoricarpos longiflorus* associations, *Pinus monophylla/Juniperus osteosperma/Artemisia nova* associations and *Juniperus osteosperma/Artemisia nova* associations (Appendix C).

Cercocarpus ledifolius had a rating of 7 to 8 whenever present in a plant association and was rated mostly unavailable to unavailable (Appendix D). This is due to the extreme highlining of this browse species. Yet the *Cercocarpus ledifolius*/Grass association had a high deer index of 61.64 and is considered one of the most important associations on the winter range.

The associations with the least use of browse species are those that had the least deer days use per acre. These were the *Artemisia tridentata/Chrysothamnus nauseosus* associations and the *Artemisia tridentata/Grayia spinosa* communities (Appendix D).

Hedging data show that the most frequently utilized browse species is *Chrysothamnus viscidiflorus*. This is due to the fact that it was present in every plant association. *Artemisia tridentata* was the second most often used species, then *Purshia tridentata, Tetradymia canescens, Symphoricarpos longiflorus, Amelanchier ledifolius, Artemisia nova* and *Cercocarpus ledifolius* (Appendix D). The least often used species were *Artemisia arbuscula, Sambucus glauca, Grayia spinosa, Eurotia lanata,* and *Prunus virginiana*. This may be

accounted for by the low frequency of occurrence of these species in the plant associations.

The most heavily used species was *Cercocarpus ledifolius* Table 30), then *Purshia tridentata, Amelanchier alnifolia, Sambucus glauca, Prunus virginiana* and *Chrysothamnus viscidiflorus*. The least heavily used browse species were *Grayia spinosa, Eurotia lanata, Artemisia arbuscula* and *Tetradymia canescens* (Table 32).

POSSIBLE IMPROVEMENTS

The goal of game range restoration is the development of a productive stand of desirable shrubs and herbs. Where some important forage plants are present, reduction of competition by appropriate methods may be all that is necessary to achieve the desired restoration. Perhaps some change in management to lessen grazing pressure would result in an adequate stand of desired species. To maintain bitterbrush/sagebrush and similar associations in high productivity it may be necessary to consider the elimination of sheep from areas important as deer habitat. Cattle grazing then could be used as a tool to manage the vegetation following principles described by Hormay (1970).

Reviewing the data obtained on cover percentages of important browse species in some of the *Pinus monophylla* and/or *Juniperus osteosperma* dominated associations indicates the browse availability and production can be increased by chaining. To accomplish satisfactory improvement without seeding, at least one desirable shrub and 10 desirable herbs per 100 square feet should be present (Plummer, 1968).

The pinyon-juniper woodland associations which contain enough browse species at the present time to give a feasible increase in browse production are: *Juniperus osteosperma/Pinus monophylla/Purshia tridentata/Artemisia tridentata; Juniperus osteosperma/Pinus monophylla/Artemisia tridentata; Pinus monophylla/Juniperus osteoperma/Artemisia nova* associations; and *Juniperus osteosperma/Artemisia nova.*

To get improved browse production and still maintain deer use on these plant associations it is advisable to chain the area by strips. This was first elaborated by Leopold (1933). Cole (1968) also provided data supporting

the "edge effect" described by Leopold. Theoretically, the greater interspersion of vegetation types, the greater habitat use by the game species, owing to "simultaneous access" of various types which fill some animal requirements, in this case cover and browse. Cole (1968) also stated that "the highest utilization by deer occurs within the treated range adjacent to the peripheries, while lowest use occurs in the center of the treatment."

TABLE 32. Most Often and Heaviest Used Browse Species on the Winter Range in Descending Order

Most Often Used	Heaviest Used
1. *Chrysothamnus viscidiflorus*	1. *Cercocarpus ledifolius*
2. *Artemisia tridentata*	2. *Purshia tridentata*
3. *Purshia tridentata*	3. *Amelanchier alnifolia*
4. *Tetradymia canescens*	4. *Sambucus glauca*
5. *Symphoricarpos longiflorus*	5. *Punus virginiana*
6. *Amelanchier alnifolia*	6. *Chrysothamnus viscidiflorus*
7. *Artemisia nova*	7. *Artemisia tridentata*
8. *Cercocarpos ledifolius*	8. *Symphoricarpus longiflorus*
9. *Prunus virginiana*	9. *Artemisia nova*
10. *Eurotia lanata*	10. *Tetradymia canescens*
11. *Grayia spinosa*	11. *Artemisia arbuscula*
12. *Sambucus glauca*	12. *Eurotia lanata*
13. *Artemisia arbuscula*	13. *Grayia spinosa*

LITERATURE CITED

Blackburn, W. H. 1967. Plant succession on selected habitat-types in Nevada. M. S. Thesis, University of Nevada Reno. 162 p.

Blackburn, Wilbert H. and Paul T. Tueller. 1970. Pinyon and juniper invasion in black sagebrush communities in East-Central Nevada. Ecology 51(5):841-848.

Bradshaw, K. E. and J. L. Reveal. 1943. Tree classifications for *Pinus monophylla* and *Juniperus utahensis*. J. of Forestry 41 (2): 100-101.

Cole, N. J. 1968. Mule deer utilization of rehabilitated Nevada rangelands. M. S. Thesis. University of Nevada Reno. 132 p.

Daubenmire, Rexford. 1968. Plant communities: A textbook of plant synecology. Harper and Row Publ., New York. 300 p.

Forest Service Handbook. 1964. F.S.H. 2212.01, R-4 Range Analysis Handbook. p. 41.28-0.

Hanson, Herbert C. 1961. The plant community. Reinhold Publishing Corp., New York. 218 p.

Hormay, August L. 1970. Principles of rest-rotation grazing and multiple-use land management. U. S. Dept. of Agriculture Training Test 4(2200). U. S. Forest Service. 26 p.

Leopold, A. 1933. Game management. Charles Scribner's Sons, New York. 481 p.

Plummer, A. P. 1968. Restoring big game range in Utah. Publication No. 68-3, Utah Division Fish and Game. p. 20-21.

APPENDIX A
APPARENT TREND

VEGETATION

Up or Stable	Down
1. Desirable frequency groupings and age classes of desirables, intermediates, and least desirables.	1. A disproportionate amount of intermediates and least desirables. Seedlings of better plants having difficulty in becoming established.
2. Forage plants not being pulled up or trampled out by grazing.	2. Forage species being pulled up and trampled out by grazing.
3. Vigor of key species high as indicated by leaf length, seed stock production and normal color.	3. Low vigor of key species as indicated by reduced size of plant, leaf length of seed stalks, and off color (sickly yellow).
4. Browse species showing no hedging.	4. Browse species showing moderate to heavy hedging.

SOIL

1. Ground cover dispersion - uniform.	1. Ground cover dispersion - variable to highly variable.
2. No detectable soil movement.	2. Soil movement detectable.
3. Soil surface continuous and intact.	3. Cupping out between soil remnants.
4. No exposure of plant roots.	4. Plant roots exposed.
5. Stones and rock fragments, where present, normal and in place - no movement of rock fragments.	5. Stones and rock fragments, where present concentrating on surface as erosion pavement. Fragments loose and often moving downslope.

APPENDIX A
APPARENT TREND
(Con't.)

SOIL

Up or Stable	Down
6. Lichen lines on stones and rock fragments extend to soil level.	6. Lichen lines on stones considerable above soil surface - no lichens on rock fragments.
7. No active gullies.	7. Active gullies - indicated by recent cutting and sloughing.
8. No recent soil deposits either alluvial or aeolian.	8. Recent soil deposits - alluvial or aeolian.
9. No wind-scoured depressions.	9. Wind-scoured depressions.

APPENDIX B
Townships and Sections of the Study Area

	T28N R63E	T27N R63E	T26N R63E	T28N R62E	T27N R62E	T26N R62E
N. Cherry Creek Range	17,18,19, 20,28,29, 30,31,32, 33	4,5,6,7,8: 9,17,18, 26,27,28, 31,32,34, 35	2,3,4,5,6: 7,8,9,10, 11,14,15, 16,17,18, 19,20,30,	25,35,36,	1,2,11, 12,35,36,	1,2,11, 12,13,14, 23,24,25,

	T31N R63E	T31N R64E	T30N R63E	T30N R64E
Spruce Mountain	10,11,12, 13,14,15, 16,21,22, 23,24,25, 26,27,28, 35,36,	11,12,13, 14,17,18, 19,22,23, 24,25,26, 27,28,29, 30,31,32, 33,34,35,	1,2,12, 11,13,14, 23,24,	3,4,5,6, 9,10,

	T24N R57E
Bald Mountain	14,15,23, 22,21, 20,28,27, 26,34,35,

	T28N R58E	T28N R57E	T27N R58E	T27N R57E	T26N R57E	T25N R57E
South Ruby	29,30,31,	36	6,7,	1,12,13, 14	1,2,11,10: 14,15,16, 28,33,34,	3,4,10,9,: 15,16,17,: 21,28,29,: 30,31,32,: 33

	T25N R56E	T24N R57E
South Ruby (Con't.)	13,24,23, 26,25,36,	5,6,

	T23N R57E	T23N R58E	T22N R57E
Mooney Basin	13,14,22, 23,24,25, 26,27,32 33,34,35, 36,	18,19, 30,31,	1,2,3,4, 5,

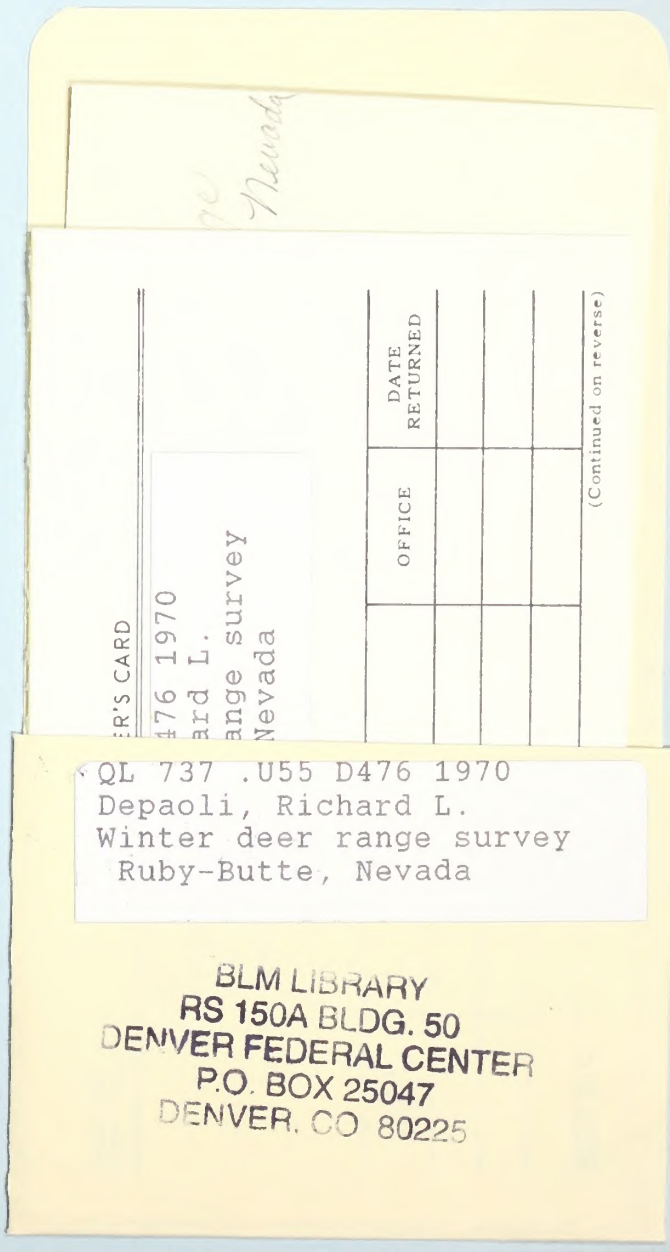
APPENDIX C
List of Community Importance as to
Number of Deer Days Use per Acre

		Average	No. of Plots	Range
1.	*Cele/Sylo/Chvi*	185.38	1	
2.	*Artr/Arno/Putr*	127.69	1	
3.	*Artr/Elci*	102.27	1	
4.	*Cele*/Grass	61.64	2	50.96-72.31
5.	*Putr/Artr*	58.92	4	39.24-79.23
6.	*Chvi/Putr/Artr*	49.62	1	
7.	*Arno/Putr*	47.69	1	
8.	*Artr*/Grass	39.69	6	10.34-90.23
9.	*Artr/Feid*	37.23	1	
10.	*Chvi/Putr/Artr/Sylo*	35.67	2	20.67-50.66
11.	*Artr/Brte*	32.05	1	
12.	*Artr/Sylo*	30.49	7	7.69-65.12
13.	*Arno/Amal*	28.46	1	
14.	*Juos/Arno*	23.71	2	18.46-28.95
15.	*Arar*/Grass	21.35	3	18.61-22.74
16.	*Pimo/Juos/Arno*	19.76	5	4.61-41.54
17.	*Cele/Artr*	17.69	1	
18.	*Arno*/Grass	16.88	4	9.23-26.15
19.	*Arno/Artr*	15.84	2	15.51-16.16
20.	*Pimo/Juos/Cele*	15.38	1	
21.	*Juos/Pimo/Putr/Artr*	11.37	1	
22.	*Juos/Pimo/Artr*	10.34	1	
23.	*Pimo/Juos*	10.15	4	5.71-20.67
24.	*Juos/Pimo/Putr*	9.23	1	
25.	*Amal/Chvi*	9.12	1	
26.	*Artr/Chna*	7.34	2	6.21-8.46
27.	*Artr/Grsp*	4.66	2	0.00-9.32

APPENDIX D
List of Plant Associations
Heaviest Browsed to Least Browsed

Rate as to Deer Index	Plant Association	*Artr*	*Putr*	*Chvi*	Other
2	*Artr/Arno/Putr*	3	7	6	
6	*Chvi/Putr/Artr*	2	7	3	
21	*Juos/Pimo/Putr/Artr*	3	7	2	
8	*Artr*/Grass	2	7	2	
10	*Chvi/Putr/Artr/Sylo*	2	6	2	
16	*Pimo/Juos/Arno*	2	5	6	
14	*Juos/Arno*	-	5	2	
25	*Amal/Chvi*	3	4	3	6*(Amal)*
23	*Pimo/Juos*	2	4	2	
3	*Artr/Elci*	1	4	2	8*(Cele)*
5	*Putr/Artr*	3	3	2	
24	*Juos/Pimo/Putr*	-	3	-	
12	*Artr/Sylo*	2	2	3	6*(Amal-Puvi)* *(Sagl)*
18	*Arno*/Grass	2	2	3	
4	*Cele*/Grass	2	2	2	7*(Cele)*
7	*Arno/Putr*	1	2	1	
9	*Artr/Feid*	3	-	3	
11	*Artr/Brte*	3	-	3	
17	*Cele/Artr*	2	-	2	7*(Cele)*
1	*Cele/Sylo/Chvi*	2	-	2	7*(Cele)*
20	*Pimo/Juos/Cele*	2	-	3	8*(Cele)*
22	*Juos/Pimo/Artr*	2	-	3	
19	*Arno/Artr*	1	-	2	
13	*Arno/Amal*	-	-	2	6*(Amal)*
15	*Arar*/Grass	-	-	2	3*(Arar)*
26	*Artr/Chna*	1	-	2	
27	*Artr/Grsp*	1	-	1	3*(Eula)*

BLM LIBRARY
RS 150A BLDG. 50
DENVER FEDERAL CENTER
P.O. BOX 25047
DENVER, CO 80225


Nevada
R'S CARD
476 1970
ard L.
ange survey
Nevada
OFFICE
DATE RETURNED
(Continued on reverse)
QL 737 .U55 D476 1970
Depaoli, Richard L.
Winter deer range survey
Ruby-Butte, Nevada
BLM LIBRARY
RS 150A BLDG. 50
DENVER FEDERAL CENTER
P.O. BOX 25047
DENVER, CO 80225